APPENDIX D *HES 1995* RECOMMENDATIONS AND RESULTS

HES 1995 findings and recommendations were initially presented in Chapter 9 of the *Hawaii Energy Strategy Report*. Those recommendations and their results are presented here. Some of the recommendations have been edited or abbreviated for this summary. The recommendations were not numbered in the original report, but are so organized in this Appendix.

Recommendation 1: Diversify Fuels and Sources of Supply

Oil is likely to remain Hawaii's primary fuel for the foreseeable future. Hawaii must recognize that it faces potentially volatile oil prices and potential supply problems and that the State should continue to seek diversification of fuels and sources of supply (DBEDT 1995a, 9-2).

Results. Decreases in oil prices over the period 1995–1998 made Hawaii's efforts to diversify fuels and sources of supply more difficult because the economic advantages of many renewable resources were reduced – although not eliminated. In addition, closure of the Makani Uwila wind farm, on Oahu, and closure of all sugar plantations on Oahu and Hawaii (and some plantations on Kauai) reduced renewable energy production from biomass and hydroelectricity. The former Waialua Sugar Mill, on Oahu, became Waialua Power in 1997 and produced electricity from waste oil and green waste until it closed in 1998.

There was a notable success. On the Big Island, Puna Geothermal Venture increased its capacity from 25 MW to 30 MW in 1996 and provided up to 25% of Hawaii County's electricity.

In addition, there was increased use of coal beginning in 1992, and utility Integrated Resource Plans (IRPs) call for future additional coal-fired generation on Oahu and Kauai. More detail on coal can be found in the discussion of Recommendation 3, below.

Recommendation 2: Focus Diversification on Power Generation and Ground Transportation Energy

Hawaii's energy diversification plans should first focus on conversion of power generation and process heat to fuels other than oil, and transportation energy to 10% alcohol/gasoline blending. Substituting oil demand much beyond one-third of current use involves bolder and more speculative measures (9-2).

Results. Power generation and ground transportation continue to be the focus of DBEDT's efforts in seeking energy diversification. These areas offer the greatest opportunities for greater efficiency and application of renewable alternatives to fossil fuel use.

Recommendation 3: Pursue Coal as an Option for Oahu Energy Diversification

Coal offers an opportunity for diversification of Hawaii's energy supply. The long-term price of coal is not expected to increase significantly, and coal is

projected to remain the lowest fuel-cost option for large power plants on Oahu. The higher relative costs of smaller coal plants, sized for the neighbor island utility systems, make them less attractive options for now (9-2).

Results. Hawaiian Electric Company considered a number of options using coal-fired units in its second IRP. The final plan selected included a 180 MW (AFBC) plant scheduled for 2016. With the scheduled retirement of the Kalaeloa 180-MW LSFO-fired DTCC unit in that year, additional baseload generation will be required, shortening the economic payback period. The plan selected offers fuel diversification without significant added cost (HECO 1998b, 11-34).

In addition, when the AES Hawaii 180 MW AFBC plant was built at Campbell Industrial Park, on Oahu, in 1991-1992, it was designed to allow construction of a second 180-MW AFBC plant on site. The second plant would share much of the existing infrastructure, including coal-handling and transport conveyor equipment and storage. Such an approach remains an option for installation of additional coal-fired generation.

On the Big Island, with the closure of sugar operations, the former Hilo Coast Processing Company converted its steam generator to use coal as fuel and renegotiated its contract to increase the power it provides to HELCO from 18 to 22 MW. The HCPC power purchase agreement expires at the end of 1999 but HCPC is attempting to negotiate a new agreement or extension to increase the capacity provided (HELCO 1998b, ES-10).

Kauai Electric's second IRP schedules a 24-MW coal steam generator for 2014, providing additional diversification (KE 1997b, 1-1).

While coal offers fuel diversification to Hawaii, growing concern about the effects of greenhouse gas emissions on global climate may make coal use less attractive. Coal produces about 20% more CO_2 per equivalent Btu than oil. Nevertheless, such emissions may be offset by carbon sequestration projects such as the forest preserve voluntarily funded in Paraguay by AES Hawaii in 1991. This preserve sequesters twice as much CO2 as AES Hawaii will emit over its lifetime.

Recommendation 4: Encourage Hawaii's Refineries to Upgrade Capabilities

Increased refinery flexibility would enhance refiners' capability to respond to changes in the world oil market and give much more latitude to State programs in alternative fuels. The refinery upgrades needed would include additional improvements to facilities, including some expansion of crude distillation and catalytic reforming capacity, and substantial expansion of hydrocracking capacity (DBEDT 1995a, 9 2).

Results. This recommendation encouraged additional crude and conversion capacity additions by Hawaii's refineries to enhance the ability to respond to changes in world oil markets. According to Mr. Tom Simons, Chevron Hawaii Refinery Resources Superintendent, "Chevron makes investments in upgraded facilities based on the market-driven economics for justifying expenditures. To the extent that changes in market economics make upgrading facilities economically viable, Chevron has and will continue to make these investments."

Tesoro Hawaii reported that the following projects have been implemented since 1995.

- A mercaptan-treating unit was installed, allowing purchase of crude oil containing mercaptan sulfur components. The unit can remove these components, increasing refinery flexibility and allowing it to purchase crude oil from a larger number of sources.
- Additional flexibility permitting the refinery to purchase very light crude oil was achieved by re-engineering the upper part of Tesoro Hawaii's crude distillation tower with new trays and debottlenecking the overhead system (McMullen 1999).

Recommendation 5: Increase Use of Renewable Energy

Increase use of renewable energy to decrease Hawaii's dependence on oil (9-2).

Results. Renewable energy use was not increased significantly during the period. With the decline of the sugar industry, the percentage of electricity sold by the utilities generated from bagasse declined from 3% in 1990 to 1.1% in 1991. The closure of Makani Uwila wind farm on Oahu in 1996 contributed to the decline of the wind-energy contribution from 0.4% in 1990 to 0.2% in 1997. The addition of geothermal energy to the mix helped offset these losses. Run-of-the river hydroelectric plants provided additional renewable energy. A landfill-methane-powered generator operated on Oahu. The following table shows the percentage contribution to utility electricity sales by renewable energy by source. Note that municipal solid waste (MSW) burned at the H-POWER plant remains the main source of renewable energy.

Table D-1. Percentage Contribution to Utility Sales by Renewable Resource, 1990–1997

	1990	1991	1992	1993	1994	1995	1996	1997
Bagasse	3.0%	3.0%	2.7%	2.4%	2.3%	1.5%	1.4%	1.1%
Geothermal	0%	0%	0%	1.5%	1.8%	2.3%	2.3%	2.3%
Hydroelectric	0.7%	0.6%	0.4%	0.4%	0.6%	0.5%	0.5%	0.4%
Wind	0.4%	0.3%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
LF Methane	0.1%	0.2%	0.2%	0.1%	0.2%	0.1%	0.1%	0.2%
MSW	3.5%	3.6%	3.5%	3.3%	3.5%	3.5%	2.8%	3.8%
Total Renewable	7.7%	7.7%	7.0%	8.0%	8.6%	8.0%	7.4%	7.9%

Recommendation 6: Focus First on Cost-Effective Energy Efficiency and Conservation

Conservation and demand-side management (DSM) measures could result in substantial energy savings and are likely to be the most cost-effective ways of lowering current levels of dependence (9-3).

Results. Energy efficiency and conservation are proving highly cost effective in reducing energy use. Measures include adoption of the Model Energy Code, performance contracting efforts, and continued use of utility demand-side

management programs. These efforts are reviewed in more detail in the body of the *HES 2000* report.

Recommendation 7: Consider HES DSM Measures in Utility Integrated Resource Planning

Utilities should be encouraged to evaluate the DSM measures found to be cost effective by HES program models. All those that are cost-effective should be included in their IRPs (9-3).

Results. While the utilities developed their DSM programs independently, many of the measures that were recommended in *HES 1995* became part of the utility programs. Utility adoption was not necessarily a result of *HES 1995* recommendations, but the work of the program contributed to the dialogue. Recommendations for mandated measures were either not pursued further because such efforts were not deemed necessary or because their adoption was infeasible

In the residential sector, all of the utilities provided residential efficient water heating programs offering rebates on solar water heating, heat-pump water heating, and efficient water heaters. Some utilities have distributed or provided rebates for compact fluorescent light bulbs and low-flow shower heads. Such measures as second refrigerator removal and horizontal axis clothes washers were not found to be cost effective. One proposed mandate, load control devices on electric water heaters, is under consideration as a voluntary DSM measure by at least one utility.

In the commercial/industrial sector, most of the DSM options recommended are part of a variety of customized-rebate DSM programs available for new construction and for existing commercial/industrial buildings. These include rebates for optical reflectors, T-8 fluorescent bulbs with electronic ballasts, occupancy sensors, heat pumps, and electronic ballast refits. Solar process-heat and most of the recommended mandates have not yet become part of utility DSM programs. Building energy-management systems, proposed as a mandate, could be obtained voluntarily by building-owners with rebates under utility custom programs.

Recommendation 8: Evaluate DSM Mandates

The State government should consider the proposed mandates in light of their capability to reduce energy demand. In some case, the actions could be encouraged as part of the Model Energy Code (9-4).

Results. It was decided not to pursue DSM mandates beyond the provisions of the Model Energy Code due to the relatively small effect that the proposed mandates might have. Some measures, such as load control devices on water heating systems are under consideration for voluntary installation as part of utility DSM programs.

Recommendation 9: State and Utilities Should Cooperate on DSM Data Gathering

The State and the utilities should cooperate further on data gathering in support of DSM measures and program design (9-4)

Results. DBEDT and the utilities continue to cooperate on the development of DSM measures and program design through DBEDT participation in utility IRP advisory groups. Resource limitations have reduced DBEDT's ability to develop new recommendations. The HECO utilities did, however, adopt *HES 1995* Project 4's assessment of DSM potential impacts, as reported in *Hawaii Demand-Side Management Opportunity Report*, to select the optimum level of DSM in the second round of IRP (HECO 1998b, 7-3).

Recommendation 10: Adopt Transportation Energy Conservation Measures

Energy conservation can greatly decrease the absolute amount of energy that would be required for transportation in comparison with a future without conservation measures. Recommended measures to encourage transportation energy conservation follow (DBEDT 1995a, 9-4).

A. Improve Vehicle Fuel Efficiency

Vehicle fuel efficiency has a powerful effect on total ground transportation energy demand. The technology for significant increases in fuel efficiency is available. Cars that average more than 50 miles per gallon are in showrooms today, and prototypes that can travel 70–120 miles on a gallon of gasoline have already been developed (9-4).

Results. While industry has provided many vehicles with greater efficiency for sale, the popularity of larger automobiles, sport utility vehicles, and light trucks – in combination with historically low gasoline prices – has reduced the demand for fuel-efficient vehicles. As discussed in *HES 2000*, Chapter 3, it appears that the average efficiency of Hawaii's vehicles has declined in recent years.

B. Adopt More Stringent CAFE Standards

Hawaii could challenge the federal law that preempts states from setting their own standards. If successful, Hawaii could then institute fuel efficiency standards more stringent than the national Corporate Average Fuel Efficiency (CAFE) standards and thus reduce demand for transportation fuels of all types (9-4).

Results. This recommendation has not yet been pursued. However, alternative-fuel vehicles have become increasingly available, at least partly due to the provision in the existing fuel efficiency standard that gives manufacturers of alternative-fuel vehicles "credit" toward meeting the CAFE standard. For example, flexible-fuel capability is standard in Model Year 1999 Chrysler minivans and Ford Ranger pickup trucks (Chrysler 1997 and Frey 1998).

C. Improve Efficiency of State Vehicle Fleet

The State government should set an example by improving the efficiency of its fleets. For example, a fleet rule could be established that would require the procurement of County and State vehicles that are 2.5 mpg higher than the current CAFE standard. While this would not save large amounts of energy, such a program would set an example and introduce additional people to higher-efficiency vehicles (9-4).

Results. This recommendation has not yet been pursued.

D. Adopt Travel Reduction Measures

The measures with the greatest potential to decrease vehicle miles traveled (VMT) in Hawaii, and particularly in the City and County of Honolulu, were transit programs, transportation management associations, actions by educational institutions, high-occupancy vehicle (HOV) facilities and meaningful enforcement, automobile use limitations (such as road pricing), and land use planning (9-4).

Results. The City and County of Honolulu has announced plans to increase the number of buses in its bus system. In addition, HOV facilities have been added and improved, most recently with the addition of "zipper lanes," moveable barriers that separate HOV traffic from non-HOV traffic. Enforcement of HOV lanes was also improved. Ride sharing and vanpool promotion activities have continued. Also, Kapolei, which is intended to become a "second city" and provide increased employment opportunities in a central location outside the existing central business district, have progressed. These were discussed in more detail in Chapter 4. Other recommended measures have not been adopted.

E. Increase the Focus on Energy in the Transportation Planning Process

Energy use currently receives very little emphasis in the State's transportation planning process. There is statutory authority for energy concerns to play a much larger role. For example, the *Intermodal Surface Transportation Efficiency Act* has energy efficiency as a goal, and the Clean Air Act Amendments of 1990 support energy efficient strategies. It would be helpful to update and maintain ground transportation sector energy demand projections such as VMT projections to show the energy consequences of transportation policy decisions in the State Transportation Improvement Plan (9-4).

Results. The State Energy Office has assisted the Technical Advisory Group of the Oahu Metropolitan Planning Organization's Model Development Task Force. Energy use and costs are included in the model so that when transportation and land use alternatives are considered in the future, the energy impacts may be quantified.

F. Increase the Focus on Energy in Land Use Planning Process

Land use planning at the State and local levels has not emphasized transportation energy use. Land use patterns can, over time, have a powerful effect on transportation energy use, and an increased emphasis on transportation energy use during the

land use planning process (e.g., revisions to Development Plans) would help achieve State goals (9-5).

Results. The process initiated by Mayor Harris in the City and County of Honolulu considers energy as a component of the vision of sustainable communities intended to become part of the City and County of Honolulu General Plan.

G. Expand Use of Alternative Fuels and Vehicles

There are already several hundred alternative-fuel vehicles (AFVs) in use in Hawaii. Continued and expanded use of alternative fuels and vehicles is expected to occur in response to federal and State requirements, public support of "clean fuels," and the increasing availability of alternative-fuel options on popular models of cars and trucks. The development of a local alternative-fuels industry could provide local jobs. The production alcohol fuel from agricultural materials has the greatest employment potential, although costs and benefits must be evaluated on a site-specific basis. Generally, production of alternative fuels makes sense only when done in conjunction with the production of higher-value products (9-5).

HES Project 5 also recommended specific actions for the period 1995–2002. These included incentives for off-peak charging of electric vehicles, adjustment of fuel taxes on the basis of energy content to remove a disincentive to alternative fuel use, and public education and outreach. The latter is essential for public acceptance and voluntary purchases of AFVs (9-5).

Results. A special reduced rate for recharging electric vehicles by residential and commercial customers went into effect on Maui on April 15, 1999. A similar program is under final review for Oahu (Maskrey 1999). A bill to adjust fuel taxes on the basis of energy content was drafted. It has been considered by the Legislature but has not yet passed. A variety of public and private agencies, particularly the Honolulu Clean Cities Coalition and its member organizations (including private organizations and State, federal, and County agencies) have carried out several public education and outreach efforts.

H. Use Alcohol/Gasoline Blends as Motor Vehicle Fuel

Out of the 21 transportation measures evaluated, and nine combinations of measures, an alcohol/gasoline blend program was the least costly means of encouraging the use of significant quantities of renewable, locally produced alternative transportation fuels. Low-level alcohol blends (E10 – 10% ethanol) are much closer to being competitively priced than the higher level alcohol fuels (M85 – 85% methanol and E85 – 85% ethanol), which will facilitate the introduction of alternative fuels (9-5).

The objective of alcohol blending would be to have the alcohol (most likely ethanol) produced locally. Consideration should be given to replacing the existing excise tax exemption for ethanol blends by a producer incentive available only to alternative fuel producers in Hawaii (9-5).

Results. Several potential ethanol producers have requested information on Hawaii's previous studies, incentives, and laws, and have considered or are considering the possibility of importation of ethanol or production of ethanol in Hawaii.

I. Conduct Transportation Energy Research and Development Programs

Research and development programs could play an important part in the achievement of Hawaii's energy goals. Specific recommendations for programs were provided in *HES 1995* (9-6).

Results. Several federally funded research and demonstration projects have been initiated and are ongoing. The largest is the Electric Vehicle Demonstration Program, funded by the Advanced Research Projects Agency of the U.S. Department of Defense. Several electric vehicles and electric vehicle technologies have been developed, refined, and tested in Hawaii, including a network of rapid chargers to be installed at various locations on Oahu. See Chapter 4 for additional details.

Recommendation 11: Improve State Energy Analysis

A. Improve Data Collection and Reporting

To further the understanding of State government policy makers, the State should improve its data collection and reporting system to better track imports of crude oil and refined products, Hawaii refinery production, production of indigenous energy resources, and use of these energy resources. The completeness, accuracy, and resolution of the State's data collection efforts should be improved (9-7).

Results. Since the *HES 1995* report was issued, data collection has been significantly improved and better organized into a set of useful databases. Currently, data is collected from all fuel distributors in Hawaii under procedures developed under Chapter 486E - *Fuel Distribution*, Hawaii Revised Statutes. Chapter 486E was replaced in 1997 by Chapter 486J - *Petroleum Industry Information Reporting Act*, Hawaii Revised Statues. Chapter 486J increased the scope of data collection to include the collection of fuel data from oil producers, refiners, marketers, oil transporters, and oil storers. Chapter 486J also included provisions for the collection of pricing data. Administrative rules are being developed to effect the reporting requirements of Chapter 486J.

To improve the tracking of crude oil and refined products, the data collection form was revised. The revisions increased the number of consumption sectors and improved differentiation between the fuel products. Reporting compliance by distributors was also improved through follow-up and by assisting distributors in understanding how to fill out the data collection form. A new database was developed to maintain new data in a more organized manner, and historical data back to 1982 was also entered.

The ERT Division maintains other databases that are used to help assess the completeness and accuracy of data collected from distributors. Databases are maintained on the Department of Taxation monthly fuel tax report and a more detailed database on the quantity of taxable fuel used in the City and County of

Honolulu. The division also maintains a database based upon the Energy Information Administration's Form 782c monthly report on sales of selected petroleum products by prime suppliers for local consumption. This report serves to check local fuel consumption data.

Other sources used to track energy production include the *Energy Report* provided by the Hawaii Agriculture Research Center, annual reports prepared by independent power producers, Federal Energy Regulatory Commission reports submitted by Hawaii's electric and gas utilities to the Hawaii Public Utilities Commission (PUC), discussions with utilities and independent power producers, and a variety of Internet sites.

B. Monitor Key Aspects of the World Oil Market

The DBEDT Energy Division should monitor the world oil market and Hawaii's relationship to that market, to better understand and predict the effects of the market on Hawaii's economy. Concentration should be placed on the Asia-Pacific oil market and on oil production in Alaska and other areas that become sources of crude oil for Hawaii's refineries or of imports of refined products (9-8).

Results. Collection of data on the world oil market was improved since the *HES 1995* report, and a set of databases was developed to follow long-term trends. ERT collects data on the quantities of foreign or domestic crude oil imported to Hawaii. Data on crude oil imports from local refiners and importers is supplemented by data from the Energy Information Administration on foreign crude oil imports by country of origin.

Sources used to monitor the world oil market include EIA's *Weekly Petroleum Status Report*, and Internet sites such as Energy Intelligence Group and Oil World. Additional work is needed to better monitor oil supply and prices in the Asia-Pacific area. Databases need to be developed to provide a historical series of oil supply and pricing data.

C. Improve Energy Planning and Policy Development

1. Formalize Comprehensive, Integrated Energy Planning as a Statutory Requirement

HES 1995 recommended that the State formalize comprehensive, integrated energy planning as a statutory requirement by amending Chapter 196, HRS, and provide resources to continue this requirement triennially by 1997. Implementation of this recommendation is also supported by Act 96, SLH, 1994, an Energy and Environmental Summit initiative that strengthened the energy section of Chapter 226-18, HRS (9-8).

Results. The preparation of *Hawaii Energy Strategy 2000* demonstrates the State's commitment to comprehensive, integrated energy planning to support the State's statutory energy policies. Although Chapter 196, HRS, was not amended to mandate the triennial planning cycle, this statute does require the Energy Resources Coordinator to develop recommendations related to improving Hawaii's energy situation by achievement of the State's energy policies, Chapter

226-18, HRS. *HES 2000* was delayed due to lack of staff time, but DBEDT plans to continue this important activity on a triennial schedule in the future.

2. Support DBEDT Energy Division Staff Positions with State Funds

HES 1995 also recommended that by 1999 the State support with State funds DBEDT Energy Division staff positions that are currently funded by federal funds (9-8).

Results. This recommendation was not implemented. Due to severe fiscal constraints, the Energy Program, like other programs in the State, has had its mission expanded to literally "do more with less." To accomplish this, the Energy Program has been successful in developing, through competitively awarded grants, over $2 million for program activities over the past four years. Accordingly, until the State's fiscal condition improves, the Energy Program will continue to leverage its available State funding by developing other-than-State funding for program activities.

3. Complete the Assessment and Assignment of Externalities Values of Energy Resources in Hawaii

Working with public and private organizations from Hawaii's energy community, complete the assessment and assignment of externalities values of energy resources in Hawaii by 1997. This work supports the mandates of the PUC (IRP) and State Legislature (Act 96, SLH, 1994) regarding factoring external costs and benefits into energy planning in the utility and transportation energy sectors.

Results. The ERT Division of DBEDT participated, along with a variety of public and private stakeholders, in the HECO companies' Externalities Advisory Group (EAG). The Externalities Study was initiated in November 1994, but work began in November 1995 following selection of a consultant and development of a work plan. It resulted in completion of a *Hawaii Externalities Workbook,* submitted in July 1997 (with a number of caveats by the companies), to the PUC as their proposed "findings and recommendations regarding the identification and quantification of externalities" (HECO 1997b, Atch III, p.1).

In its comments on the *Workbook*, DBEDT acknowledged that it represented a major effort, at considerable expense on the part of the companies and their contractors. It is the most thorough inventory and analysis of the externalities resulting from the production of electricity in Hawaii available. A good faith effort was made to involve the EAG in the process and the companies were receptive to comments, additional information, and suggestions made by the Group.

Nevertheless, DBEDT had a number of concerns about the resulting document, and believes that economic externalities and global warming impacts were not adequately covered. DBEDT also believes that the $43 per ton emissions fee charged by the State Department of Health should not have been used to reduce the costs of damages produced by air pollutants.

As promised in the HECO companies' statement of position on the report, externalities received greater attention in the second round of IRP. All externalities that were quantifiable were listed for each plan alternative and were

monetized for the few categories where values were developed in the *Workbook*. While it is not clear that this effort had major effect on ultimate plan selection, it makes the externalities explicit in the process.

DBEDT does not have the resources to do an independent externalities study, but continues to monitor the issue for sources of alternative valuations. In addition, under a grant from the U.S. Environmental Protection Agency, DBEDT produced an *Inventory of Hawaii Greenhouse Gas Emission, Estimates for 1990* in 1997, and the *Hawaii Climate Change Action Plan*. These studies served as a basis developing goals for greenhouse gas reduction and suggested a variety of continuing and new measures for future reductions. DBEDT intends to emphasize the need to consider such emissions through its participation in the utility IRP advisory group process.

Externality costs and benefits for the transportation sector have not been developed.

4. Open a Collaborative Dialogue on the Future of Oil in the State's Energy Supply

As State policies on alternative fuels are shaped, there should be ongoing discussions with the energy industry about the timing and impacts of measures under consideration. The dialog would identify solid technical arguments and could identify areas where support could be forthcoming. The triennial planning process that was recommended by the HES program could serve this function (9-8).

Results. The collaborative dialogue was not initiated due to resource limitations.

5. Focus Planning on Energy Efficiency, Fuel Substitution, and Developing Alternative Energy Resources

Planning focus should be on improvements in energy conservation and using energy efficiently, encouraging cost-effective fuel substitution, and developing alternative energy resources (9-8).

Results. The planning focus as recommended by *HES 1995* was adopted in subsequent ERT Division activities. These actions are detailed in this Appendix in the discussions of specific related recommendations.

Recommendation 12: Improve Energy Modeling

The ENERGY 2020 model, the DBEDT DSM Assessment Model, and the Renewable Energy Resource Supply Curve model will continue to be valuable tools for analysis. Uses include energy planning and policy development, supporting DBEDT participation in the IRP process, evaluating new business development options, exploring the impacts of proposed energy incentives or disincentives. The necessary resources should be devoted to maintenance and upkeep of the models.

A. *Improve the ENERGY 2020 Model*

DBEDT Energy Division staff has been trained in the use of ENERGY 2020. The intention is for the staff to maintain, use, and develop the capabilities of the model (9-8).

Results. The ENERGY 2020 Model was used in the development of the *Hawaii Climate Change Action Plan* (HCCAP) in 1997 and 1998. While ERT staff was not able to maintain or program the model, they helped calibrate the model, reviewed model output, and prompted refinements made by the contractor. ERT staff designed the scenarios tested in the model.

As part of the work on HCCAP, the staff of ERT received training in model calibration in April 1997 and in scenario development and model runs in February 1998. The model runs conducted in mid 1998 for the HCCAP were directly applicable to *HES 2000* and were used as an analytical basis for the report.

As staff time permits, ERT Staff intends to work on understanding the model with the aim of learning to use it without the aid of the consultant. The consultant recently announced that a Windows version of the model was nearing completion. ERT will evaluate this version to determine whether it is easier to use. Should it represent a substantial improvement over the current DOS-based version, a contract to obtain a Hawaii version will be considered.

B. *Interface ENERGY 2020/REMI with State Economic Model*

This project demonstrated the need for a current official State forecast of macroeconomic variables; the last published State forecast was seven years old at the time of this report. Due to the absence of a current official forecast of macroeconomic variables, the REMI model was adopted and adapted for use by the Hawaii version of ENERGY 2020. The Research and Economic Analysis Division (READ) of DBEDT is currently updating the 1988 forecast, and these results will be compared with REMI outputs. However, the State should have only one “official” forecast, and all State agencies should use it (9-9).

The REMI model directly interacts with ENERGY 2020. It remains to be decided whether an interface between READ’s model and ENERGY 2020 will be developed, or whether REMI will continue to be used for energy forecasting. Either option will require additional resources. The results from READ’s forecast could be used in ENERGY 2020, but without the interface between the economic forecast and ENERGY 2020, the feedback effects would be lost (9-9).

Results. The DBEDT Research and Economic Analysis Division released a new official State forecast, Population and Economic Projections for the State of Hawaii to 2020 (DBEDT 2020 Series), in May 1997. ERT staff used the final draft version of the forecast during training with their consultant in April 1997 to calibrate the REMI model for use with ENERGY 2020. Such calibration represented the best option at the time. ERT now owns the Hawaii version of the REMI model and is under contract for annual maintenance updates through 2001.

C. Improve Capability to Evaluate Economic and Employment Effects of Energy Policies

The capability to evaluate economic and employment effects of energy policies should be enhanced in support of decision-making (9-9).

Results. The ENERGY 2020/REMI model combination produces estimates of the effects of alternative energy policies on a variety of economic factors, including personal income and Gross State Product. It also provides an estimate of effects on employment. Such estimates were produced in the model runs used in the *Hawaii Climate Change Action Plan* and in the *HES 2000* report. Often, proposed policies under evaluation involve very small effects on the overall State economy and differences are correspondingly small.

D. Improve DSM Modeling and Programs

The work to identify the size of Hawaii's DSM resource and identify the DSM measures with the greatest potential required explicitly estimating the impacts of DSM measures on representative Hawaii buildings using Hawaii-specific weather files. This methodology was based on the best information available. The State's DSM modeling capability should be improved to support evaluation of utility DSM programs (9-9).

Results. Additional resources have not been available to pursue this recommendation.

Recommendation 13: Increase Use of Indigenous, Renewable Energy Resources

A. Improve Power Purchase Contract Terms for Renewable Energy

Economic conditions unrelated to the pace of technology development will also be a major factor in determining the magnitude of renewable energy integration in Hawaii. Avoided-cost payment levels or power purchase contract terms will pay a large role in determining the renewable energy projects that can be developed. In addition to encouraging utilities to construct contracts with favorable terms for renewables the State must also allow the costs associated with these contracts to be included in the utility rate bases. Factors that have been shown to be favorable to renewables include consideration of capacity value, externalities benefits, and time-of-day pricing. Contract structures that assist in obtaining financing at favorable rates (such as front-loaded contracts and long-term contracts with specified payment schedules) will also promote development and integration of renewable energy (9-9).

Results. In 1996, a similar recommendation was made in *Strategies to Facilitate the Development and Use of Renewable Energy Resources in the State of Hawaii*, which was a report to the legislature pursuant to S.C.R. 40, S.D. 1, 1994 by the PUC. A working group of stakeholders, including renewable energy developers, utility company representatives, environmental groups, government agencies

(including DBEDT), and others had prepared the report. No modifications to power purchase contract terms have yet been made.

B. Conduct Additional Renewable Energy R&D

Encourage and support research and analysis that promote the commercial application of renewable energy in Hawaii. Studies addressing penetration limits for intermittent resources on isolated grids should be a top priority because this issue restricts deployment of intermittent renewable energy resources. These analyses should be conducted in partnership with the utilities (9-9).

Economical energy storage options would also address the issue of penetration limits. The costs and operation of promising energy-storage technologies should be evaluated using the same methodology as the Resource Supply Curve Computer Model (9-9).

The Hawaii Integrated Energy Policy project called for the development of a renewable energy research, development, demonstration, and commercialization strategy to overcome the remaining technical hurdles to renewable energy use. This also remains to be done (9-9).

Results. A biomass gasifier research and development project was carried out on Maui but was dismantled when no further resources could be provided by the partners, the State of Hawaii, the U.S. Department of Energy, and Westinghouse.

C. Conduct Renewable Energy Assessments

For projects that appear viable, detailed feasibility studies can be conducted to refine estimates of their costs and performance. This could include additional long-term renewable energy resource modeling. The developer, utility, and/or government agencies interested in developing the project may do this (9-9).

Results. Wind developers have reportedly carried out additional assessments on Maui and the Big Island. Resource limitations have precluded additional assessment by DBEDT. Several Hawaii utilities are conducting renewable energy penetration studies that will help identify the extent to which intermittent renewable resources can be deployed on their systems.

D. Obtain Access to Land for Renewable Energy Projects

One of the most important factors in eliminating renewable energy projects from consideration was the lack of available land without conflicting or potentially competing land uses. Only on the island of Hawaii and on the lightly populated islands of Lanai and Molokai were competing uses rarely an issue. Access to lands for any type of project requires a complex permitting process (9-9).

Renewable energy projects should be encouraged by active efforts to provide necessary access to land by State and County governments. Creating pre-permitted renewable-energy enterprise zones to favorable leases of State or County lands and outright land grants to developers of renewables are just two

possible options. These and other options should be explored further, and action taken, to help developers of renewables gain needed access more quickly (9-9).

Results. These recommended actions have not been pursued further due to staff limitations.

E. Develop Cost-Effective Renewable Energy Projects Now

The total generating capacity of the utility grid and projected demand growth on each island provides the greatest limitation to implementing renewable energy projects in the next ten years. It is important however, to consider the long-term value of renewable projects in near-term energy supply decisions because of the long life of fossil-fuel energy generation resources that may be put in place. In *HES 1995*, the recommendation included a detailed discussion by type of option (9-10).

Results. A number of viable wind projects already exist. In Hawaii and Maui counties, more electricity could be generated by proposed wind projects than the utilities can accept. On Oahu, a new wind project to replace the units shut down at Kahuku would be feasible.

The main solar projects installed include a large photovoltaic (PV) system at the Mauna Lani Resort, on the Big Island, and the Sunpower for Schools project of the HECO utilities. Other projects are under consideration. PV remains costly but is especially useful in areas not served by the grid.

Hybrid solar systems that use gas, biomass, or other fuels in conjunction with solar thermal heat are receiving considerable attention and have promise for Hawaii applications, but they have not been pursued.

A biomass gasifier research and development project was carried out on Maui but it was dismantled when no further resources could be provided by the partners, the State of Hawaii, the U.S. Department of Energy, and Westinghouse.

The Puna Geothermal Venture geothermal plant is successfully operating on the Big Island and has increased its output from 25 MW to 30 MW. Additional steam resources will be needed for continued long-term operations. The potential exists for additional geothermal power in the area.

Hydroelectric projects are commercially viable in Hawaii; however, a limited number of developable sites exist. Further hydroelectric development is subject to significant public opposition due to perceived conflicts with other uses.

Ocean Thermal Energy Conversion (OTEC) development was discontinued because no additional funding was provided. OTEC was not competitive in the face of low oil prices, and it is not expected to be competitive with other energy options in the next ten years In the more distant future, OTEC may offer a significant contribution to Hawaii's generation mix in the long-term.

F. Consider HES 1995 Project 3 Renewable Energy Implementation Plan

The Project 3 report presented a renewable energy implementation plan for each of Hawaii's four major islands. The plans were based upon the 2005 resource

supply curves, consideration of constraints such as projected load growth on each island, a 20 % assumed maximum penetration limit, and the nominal relative cost of energy. In all cases, the integration plans include intermittent projects totaling less than 20 % of the annual peak load. Even with this limitation, it appeared feasible to meet all new generating requirements with renewable energy additions. This was cited as an objective that the State government should pursue (9-13).

Results. DBEDT representatives on the electric utility Integrated Resources Planning Advisory Groups urged consideration of elements of the recommended plans. While renewable options were considered by the utilities, none have yet been included in the utility action plans, primarily because all fossil fuel options are cheaper.

In addition, it was not clear whether some systems could, for technical reasons, use as much as 20% intermittent renewable systems. The HECO utilities were conducting studies of their capacity for intermittent renewables as of early 1999.

Recommendation 15. Enhance Energy Emergency Contingency Planning

Project 6, the Energy Vulnerability Hazard Mitigation Study examined thirty-three proposals pertaining to Hawaii's energy systems and lifeline services. They were evaluated for cost-effectiveness and the functional effectiveness of the option. Specific Recommendations were as follows (all from DBEDT 1995a, 9-14 to 9-17):

A. Recommendations for the Electricity Industry

1. Industry Lead

a. Use ocean water for power-plant cooling water to eliminate vulnerable cooling towers.

Results. H-POWER staff indicated an interest in ocean-water cooling, but noted that the U.S. Army Corps of Engineers had not looked upon such requests favorably. It was suggested that the State and Federal governments could best resolve such permitting issues (Jones 1999).

AES Hawaii reported in June 1999 that it had investigated the need to replace its aging cooling tower. The company considered direct ocean-water cooling, but scheduling, cost, land, and permitting issues were too significant to overcome. Instead, AES Hawaii plans to replace its nine-year-old wooden cooling tower, designed for 80 mph wind loads, with a new fiberglass cooling tower designed for hurricane wind speeds of 120 mph (Kanja 1999).

b. Close radial transmission line loops on Oahu and Kauai.

Results. HECO indicates that it does not have radial transmission lines on its system. However, a major transmission loop project is being implemented to improve East Oahu reliability (HECO 1997c)

Kauai Electric reported the following:

> KE currently operates two radial lines, to the Princeville and Mana substations. If KE loses the Princeville substation, it currently can

support service to the North Shore of Kauai with its 12 kV system out of Kapaa. As load growth on the North Shore continues, however, KE expects to have to plan for closing that loop by building a 69 kV line that will have to proceed from Kilauea along the highway to Princeville. When, in 1991, KE began planning for the 69 kV line to close the loop, it was sued in the United States District Court by several citizens, the Sierra Club, and the Hawaii Audubon Society. The suit resulted in a consent decree (Civ. No. 92 00170) that was approved by the court. The consent decree required KE to surrender various permits it had obtained and applications it had filed, and to declare a moratorium on construction of 69 kV lines (i) across Kalihiwai Valley until after January 1, 1998, and (ii) along Kalihiwai Road until after January 1, 2004.

The Mana radial serves only the Pacific Missile Range Facility, which can be supported from Kekaha by KE's 12 kV line. Practically speaking, the loop to this remote location could only be closed by using the same poles, so that many common causes of outages would not be mitigated. Accordingly, KE has no current plans to close the loop on the Mana radial (Gilman and Golden 1999, 3-4).

c. Consider alternatives to wood for new transmission lines on Kauai, sections of Oahu, and the island of Hawaii.

Results. HECO reported that its current design methodology for transmission lines results in the use of steel structures for most locations and that HELCO and MECO employ the same design methodology in their 69kV transmission lines (HECO 1997c).

KE indicated that since about 1990 it has systematically considered steel poles as alternatives to wood to harden its transmission lines. Approximately 28% of KE's system now uses steel poles. Only one of the steel poles in place during Hurricane Iniki failed. (Subsequently KE determined that the failure was due to the failure of a piece of hardware that was mistakenly used by the contractor to attach a down-guy to the pole.) Engineering considerations, terrain, and community input are all taken into account when KE plans for new or replacement transmission lines (Gilman and Golden 1999, 4).

d. Existing power lines serving critical lifeline facilities should be upgraded as necessary to withstand ANSI-7 wind loading.

Results. HECO indicates that it uses guideline No. 74 for electrical transmission line structural loading, as recommended by the American Society of Civil Engineers (ASCE). The company deems this standard more appropriate for transmission lines than ANSI/ASCE-7 standards for buildings and structures. This guideline, implemented through its program of transmission line structure modification, is intended to upgrade important transmission line structures to meet more stringent requirements than those used when the structures were first constructed (HECO 1997c).

HELCO reports that it uses the G.O. 6 methodology of determining allowable wind loading for wooden-pole design for wind speeds, as recommended by the *Hawaii Island Wind Study*. For its steel transmission poles, it uses the ASCE 74 guidelines and a design wind speed of 100-mph (Lee 1999).

KE adopted new design standards for lifeline facilities in 1990. KE's steel pole system is designed for wind loading to 125 mph, with a 1.25 safety factor. Electrical equipment serving lifeline facilities (including poles, conductors, switches, and circuit configurations) has been hardened (Gilman and Golden 1999, 4).

MECO also employs the G.O. 6 methodology (HECO 1997c).

e. Wood poles should be inspected at least every five years, replaced or repaired as necessary to ANSI/ASCE 7 wind loading standards.

Results. HECO conducts an inspection and treatment of wooden poles program, which operates on a five-year cycle. Replacement and repair of poles is based on guidelines appropriate to overhead engineering standards referenced in d, above (HECO 1997c).

HELCO performs quarterly aerial inspections of all transmission lines. Ground pole inspections are done over a five-year cycle. Replacement and repair of poles is based on guidelines appropriate to overhead engineering standards referenced in d, above (Lee 1999).

KE conducts aerial inspections of its transmission system semiannually and ground inspections of the whole transmission and distribution system annually. It also performs annual termite inspections and treatments, follows an inspection work-order program, and inspects lines to ensure that all clearances are maintained as required under G.O.6. In addition, KE has stepped up its tree-trimming program, a measure that has greatly increased the reliability of its system. When pole replacements or repairs are needed, KE follows the standards set forth in the HECO construction standards manual (Gilman and Golden 1999, 4-5).

MECO reported that it followed the same procedures as HECO (Bonnet, 1999).

f. Shared use of distribution poles by communications utilities can reduce the reliability of electricity distribution circuits and should be considered prior to their installation.

Results. HECO is a member of a Joint Pole Committee that has been established to allow for a cooperative evaluation of the shared use of distribution structures (HECO 1997c).

HELCO has a joint pole agreement with the County of Hawaii and GTE-Hawaiian Tel covering the joint use of poles. HELCO, GTE, and all cable TV providers jointly review pole loading. The G.O.6 methodology is used to determine allowable loading for all new pole installations (Lee 1999).

KE has a joint pole agreement with GTE that governs the construction and maintenance of poles. To date, however, GTE has not elected to attach its lines to KE's steel poles, although KE has consistently ordered these poles with the appropriate attachments to accommodate telephone cables. The primary problem

KE has experienced in operating under the pole agreement is difficulty in getting GTE to honor its tree-trimming obligations.

Although KE has experienced some problems with heavy communications cables and highly tensioned messengers, this problem has not been as common as it has been on other islands. (Gilman and Golden 1999, 5).

MECO is a member of a Joint Pole Committee and has Joint Pole Agreements with communications utilities (Bonnet 1999).

g. All electric utilities in Hawaii should have current and complete emergency operating plans that should be exercised both internally and in conjunction with the State government and other lifeline entities.

Results. In February 1998, HECO revamped its emergency plans to provide for a comprehensive and coordinated *Energy Delivery Emergency Response Plan* (Nakamura 1998).

In July 1999, HELCO was in the process of revising its emergency plan to provide for a comprehensive and coordinated emergency response (Lee 1999).

KE maintains a detailed and multifaceted *Emergency Preparedness and Recovery Plan*, which is updated annually. KE participates in exercises and mock disaster trials with the State, County, military, and other entities. In addition, KE engages in tabletop exercises of its emergency operating plans at least annually (Gilman and Golden 1999, 5).

MECO's Disaster Plan became effective in September 1994 and was revised in May 1997. It provides "for effective and comprehensive corporate preparedness for a prompt, fully coordinated response for the safe and rapid restoration of energy services on Maui in the event of a natural disaster" (Bonnet, 1999).

h. Hazard mitigation measures to harden electric utility operations should be adopted, including anchoring transmission and distribution transformers and hardening batteries; providing flexible equipment connections; and maintaining and hardening spare equipment storage.

Results. HECO is considering modifications to its distribution standards that should result in their improved ability to withstand hurricane conditions. HECO is also studying the feasibility of a new base yard designed to store emergency equipment that will allow for survival of hurricane and earthquake loading (HECO 1997c).

HELCO currently designs new distribution substations and switching station equipment to resist earthquake forces in any horizontal direction and to transmit such forces to the equipment foundation. As part of the revision of the emergency plan that was underway in July 1999, equipment and materials storage will be evaluated (Lee 1999).

KE rebuilt its system after Hurricane Iniki and since 1990 has systematically hardened poles and other facilities during regular construction activities. For example, KE has upgraded the standards for connectors and the compression tools

that will improve connections. It has replaced its equipment storage warehouse and increased the capacity of some of its substation battery banks (Gilman and Golden 1999, 5).

MECO follows distribution standards developed or revised by HECO (Bonnet 1999).

i. Conduct wind-speed studies to determine wind-loading requirements for Hawaii's electrical facilities.

Results. A transmission-line study by the American Society of Civil Engineers, based on Hawaii's hurricane wind conditions, was used to document HECO's ANSI 7 request to the PUC. Safety factors were modified to loading factors for "ultimate strength design," in place of allowable load stress for a "working stress design" (Nakanishi 1998).

HELCO completed the Hawaii Island Wind Study that produced estimates of the extreme wind speeds that might be expected over a 50-year period. HELCO engineers now use the results of the study to determine design wind speeds for overhead and distribution transmission facilities (Lee 1999).

KE has not conducted any post Hurricane Iniki wind studies (Gilman and Golden 1999, 6).

MECO did not report on any wind study activity.

2. State Lead

a. Increase fuel storage recoverable under the utility rate base from 30 to 35 days.

Results. HECO has increased of fuel storage from 30 to 35 days without seeking cost recovery (Kageura 1998).

HELCO's fuel storage will be increased in the near future. The commercial operation of the Encogen 60-MW independent power producer facility will result in increased fuel storage reserve for HELCO units (Lee 1999).

KE's contract with its fuel supplier obligates the supplier to keep fuel sufficient for 21 days use in storage. The contract comes up for renegotiation in 2002 (Gilman and Golden 1999, 6).

MECO's average fuel storage practices are consistent with HECO's (Bonnet 1999).

b. Improve business climate for electric utilities in Hawaii.

Results. In 1998, Governor signed 14 measures into law to help businesses and Hawaii's economy. In general, the electric utilities will also benefit from an improved business climate. However, they will specifically benefit from the extension of the State solar tax credit, as a factor in their integrated resource planning.

c. General Order No. 6 (G.O. 6), rules for overhead electrical line construction should be upgraded to ANSI-7 minimum wind loading.

Results. An upgrade to ANSI-7 minimum wind loading is being incorporated in G.O. 6 by the PUC. PUC action is based on a request from the utilities modified by the PUC (Nakanishi 1998).

B. Recommendations for the Petroleum Industry

1. Industry Lead

a. Survey industry requirements for back-up electrical generation.

Results. DBEDT is conducting a survey and assessment to identify minimum emergency power needs at emergency and essential service facilities and to develop a database to document generator specifications.

Chevron reported that it operates three separate 3-MW cogeneration units at the Chevron Hawaii Refinery (totaling 9 MW generating capacity) and also has the ability to draw electricity from the HECO grid. Chevron also has full back-up generator capacity at its terminals on Oahu and the island of Hawaii. In addition, as of August 1999, the company was installing a back-up generator at their Kahului, Maui terminal, which will be on-line in 1999. Chevron's fourth terminal, on Kauai in Port Allen, does not have back-up generator facilities but is sited near the Kauai Electric power plant (Simons 1999).

Tesoro Hawaii reported that its refinery in Campbell industrial park operates a 20-MW cogeneration plant that provides an independent source of electricity and steam for the refinery. The refinery can also draw on the HECO grid, if necessary (Kusunoki 1999). Tesoro Hawaii also provided specific back-up generator requirements for its fuel terminals on Maui, the Island of Hawaii, and Kauai. On Oahu, it uses the Tosco facility.

b. Use water fill to protect petroleum storage tanks.

Results. This recommendation is intended to help protect tanks from storm surge, which could cause tanks to float off their bases.

The Chevron Hawaii Refinery reported that it has developed specific procedures for tropical storm and hurricane preparedness as part of its Emergency Plans and Procedures. Water fill is used to completely fill fresh water tanks in the refinery ahead of an emergency. Chevron's petroleum tanks are designed and located on elevated platforms, within bermed enclosures, so that the tank bottoms are above storm surge levels. This design prevents the tanks from floating off their bases and precludes the need to use water fill. Water fill may still be appropriate for lower level tanks (Simons 1999).

Water fill is used by the Tesoro Hawaii refinery as part of its emergency response procedures. Water fill is not used at neighbor-island fuel terminals due to logistical and environmental concerns. In the event of an emergency, the terminals may fill or redistribute fuel products in their storage tanks (Kusunoki 1999).

c. Replace central cooling towers at refineries.

Results. Chevron Hawaii reported that their refinery has one centralized cooling tower in addition to many decentralized fin-fan cooling units in the various process plants. In addition, Chevron uses once-through cooling from nearby aquifers in several plant processes. As modifications and upgrades are made to the refinery, they are designed with emphasis on decentralized cooling units (Simons 1999).

Tesoro Hawaii's refinery uses decentralized fan units for generator cooling and an air cooling process, as recommended in the Hazard Mitigation Report (Kusunoki 1999).

d. Promote offshore tanker mooring compatibility/interconnection between refineries.

Results. This recommendation calls for installing a land-based inter-tie between the two refineries' respective mooring facilities.

According to Chevron Hawaii, both refineries deliver fuel oil to HECO's terminal in Campbell Industrial Park, and this may permit a common connection between the two refineries. This existing product line provides flexibility for back-up supply in emergencies. In addition, the two refineries have the ability to interconnect light product lines. These interconnections provide flexibility for back-up lines in the event of an emergency (Simons 1999).

Tesoro Hawaii indicated that it supports examining the feasibility of an interconnection between Hawaii's two refineries and their respective offshore mooring facilities (Kusunoki 1999).

e. Keep petroleum terminals open 24 hours per day following a major emergency.

Results. Chevron Hawaii reported that the company's terminals on Oahu are already open 24 hours per day and that it is Chevron's policy to keep terminals open during emergencies on any of the Neighbor Islands by bringing in additional people from other Chevron locations (Simons 1999).

Tesoro Hawaii's terminals on Oahu and Maui normally operate 24 hours per day. At Hilo and on Kauai, around-the-clock operations could be maintained if merited by an emergency (Kusunoki 1999).

2. State Lead

a. Improve emergency communications capabilities on the Neighbor Islands.

Results. State Civil Defense purchased 26 mobile satellite access telephones to provide statewide coverage for emergency communications. Existing Statewide data communications networks were improved to make them more robust (Burnett 1998).

b. Promote use of the harbor on west coast of the Island of Hawaii.

Results. The *Hawaii Commercial Harbors Master Plan* calls for major improvements to Kawaihae Harbor. It includes improvements to fuel and lubricant handling and storage facilities. The Department of Transportation is developing a business plan and is starting the permitting process for these improvements (Pascua 1998).

c. Promote industry mutual assistance pacts.

Results. The value of mutual assistance pacts has been cited at Energy Council meetings and in exercise evaluations. The preparedness emphasis is to pre-position emergency assistance (Kang 1998).

4. Consider separate a Federal Emergency Management Agency - Regional Interagency Steering Committee (RISC) sub-region for Hawaii.

Results. There have been informal discussions on creating a RISC sub-region for Hawaii, between DBEDT and the U.S. Department of Energy, Region IX RISC representative.

C. Recommendations for the Gas Industry

1. Industry Lead

a. Protect LPG barges used in interisland service.

Results. The Gas Company has contingency plans to move its two LPG barges out to sea, away from any approaching hurricane (Miyasaki 1998).

b. Install automatic shutoff valves on mainline gas pipelines in urban areas exposed to earthquake risk.

Results. The Gas Company reported that it is continuing to review this recommendation but has determined not to act on it at this time, as discussed further below.

Seismic automatic shutoff valves are not required on gas main lines (or on services) by either National Fire Protection Association Standard 59 or by the US Department of Transportation Office of Pipeline Safety. This is in part because none of the available devices that are reliably triggered by seismic motion are relatively immune from trips due to other vibrations or events unrelated to earthquakes. False trips can damage commercial processes and require time-consuming and expensive pilot relightings. TGC's mainline pipelines in urban areas of Hawaii are confined to Honolulu, Hilo, and Lahaina. Table 1 of the *Hawaiian Islands Hazard Mitigation Report*, published by the USDOE in 1996 ("DOE Report"), shows that potentially damaging earthquakes occur on Oahu and Maui less than once in fifty years. On the Big Island it is once in 25 years. Based on the considerations of effectiveness and risk, as well as on historical experience, TGC does not deem the installation of seismic automatic shutoff valves worthwhile at this time.

The DOE Report suggested the possibility of a pipeline rupture in Hawaii comparable to that experienced by Texas Eastern in New Jersey. There, manual shutoff of the longline transmission mainline required 75 turns of each of three valves, which took over two hours and resulted in $25 million of preventable property damage. Significantly, in contrast to Texas Eastern's high-pressure transmission mains, TGC's Hilo and Lahaina LPG systems comprised distribution lines operating at pressures of only 6–10 psig. Unlike Texas Eastern, which had to

dispatch operational personnel from Houston, TGC handles operations for each island locally and has personnel on call 24 hours a day who can quickly respond in case of emergency. Both the Hilo and Lahaina LPG lines can be shut off manually by the closing of strategically located valves within the system. The entire system can also be quickly shut down with a few turns of a valve in the nearby base yard or holder sites. It is also worth noting that these LPG distribution systems, which are located on islands where earthquakes occur more frequently, are connected to tanks with finite fuel storage capacity. TGC's fuel-feed situation is much different than that of Texas Eastern, which was linked with other pipelines, gathering systems, and wells that responded to the leak-related mainline pressure reduction with ever-greater production.

TGC's SNG distribution system in Honolulu also operates at relatively low pressures. Again, valves capable of manual shut-off with just a few turns are located in strategically significant areas. Even the "transmission" portion of TGC's SNG system operates at a maximum pressure of 500 psig, which is low by mainland standards. Pneumatic (as opposed to motor-driven) block valves capable of remote shutoff from the SNG plant are installed approximately every five miles along the transmission line. These valves are not automatic, but are capable of virtually immediate shutoff in the event of a leak, explosion, or other emergency. The pressure of the transmission line is continuously monitored at the SNG plant.

Based on the foregoing, TGC has elected to rely, at this time, on existing valves that are geared to safe operation of the system in case of a gas leak or overpressure event, rather than on automatic valves geared to seismic motion.

c. Provide maps showing locations of key shutoff valves for underground gas utility systems to fire department officials.

Results. The Gas Company reported that it is in compliance with National Fire Protection Association Standard 59, which requires the planning and coordination of effective fire control measures with local fire and police departments. In addition, TGC is in compliance with US DOT Office of Pipeline Safety regulations (49 CFR § 192.615(a)(8)). These regulations require coordination with local fire, police, and other public officials in the event of gas pipeline emergencies, as well as coordinating with them in both planned and actual responses.

This local coordination has produced emergency response plans that are tailored to local geographic, operational, traffic, public safety, and security concerns. On Oahu, for example, TGC has a dispatcher on duty 24 hours a day, who monitors police and fire department incidents and dispatches company repair crews if needed. On Oahu, TGC has elected to provide maps showing the locations of shutoff valves to the local Civil Defense authorities, but not to the multitude of local fire departments. As part of appropriate coordination efforts, TGC has also given selected fire departments facilities tours that include general orientation and identification of red-painted gas shut-off valves. TGC recognizes that in the event of an emergency, the primary responsibility of its personnel is to protect the public safety using their knowledge of the system, then-available information, and

their specialized training. TGC plans to continue this flexible cooperation and coordination with local authorities.

2. State Lead

a. Require installation of shutoff devices on all LPG tanks in inundation areas.

Results. Automatic shutoff devices for LPG tanks are not part of the Uniform Fire Code or National Fire Protection Association regulations followed by the Counties. However, tanks over 100 gallons must have a permit to be sited and all tanks must be anchored. Further, tanks in inundation zones on Oahu must obtain approval from the State Department of Land and Natural Resources and the County Department of Land Utilization (Azevedo 1998).

D. Recommendations for Lifeline Services

1. State Lead

a. Arrange for priority restoration of commercial electric power to all lifeline entities during supply disruptions.

Results. The Energy Council was incorporated into revised State and County Energy Emergency Preparedness Plans and will be used to prioritize requests by lifeline entities during energy supply disruptions.

b. Set emergency generator standards.

Results. The promotion of emergency generator standards as the application of "best practices" for the operation and maintenance of back-up generation for emergency and essential service facilities is one of the tasks of the Emergency Generator Survey project initiated in 1999.

c. Information regarding critical locations not having back-up emergency generators should be provided to Hawaii State Civil Defense authorities.

Results. An assessment to identify emergency and essential service facilities that may need emergency generator support was initiated in 1999. The database to be developed will supplement a database being developed in a Phase I project to assess facilities with existing back-up generation.

d. Promote seven-day minimum vehicle fuel supply for emergency vehicles as a guideline.

Results. No further action has been taken on this recommendation. The applicability of the program has not been substantiated.

E. General Recommendations for Protection of Facilities in Coastal Inundation Zones

a. Flood-plain management and regulation, including zoning to discourage construction within flood plain.

Results. Information not available.

b. Improved flood warning and temporary evacuation, including use of weather radios that automatically sound an alarm when a warning signal is transmitted.

Results. Information not available.

c. Permanent evacuation and relocation of facilities from flood plains is clearly the most effective measure, but would be extremely costly in many cases.

Results. Information not available.

d. Construct facilities above flood levels.

Results. Checking with State and County agencies on the status of this recommendation.

f. Use of bulkheads, sea walls, and revetments.

Results. Checking with State and County agencies on the status of this recommendation.

Recommendation 16: Additional Actions

The HES program provided a wealth of energy data and information, a set of recommendations on how to improve Hawaii's energy system, and a set of tools to continue to evaluate options for future actions. This capability should be used for the following:

A. Develop a New State Energy Plan and Update It Triennially

Results. Due to lack of available staff time, completion of the second HES was delayed. It was completed in 1999.

B. Continue to Participate in the Utilities' IRP Processes

Results. DBEDT continues to actively participate on the Advisory Groups in each utility's IRP process.

C. Propose Legislation to Implement HES Recommendations Under State Control

Results. DBEDT proposed a resolution to the 1998 Legislature calling for the PUC to submit legislation for restructuring the electric utility system by December 31, 1998. The resolution was not passed. The Commission had initiated a proceeding to investigate electricity competition on December 30, 1996 and involved a collaborative group of parties. The parties were unable to reach consensus as to recommendations to the Commission. As a result, they each submitted individual position papers to the Commission on October 19, 1998. The 1999 Legislature passed a resolution asking the Commission to report on the status of its restructuring efforts before the start of the 2000 Legislative Session.